



TROPICS Pathfinder Evaluation

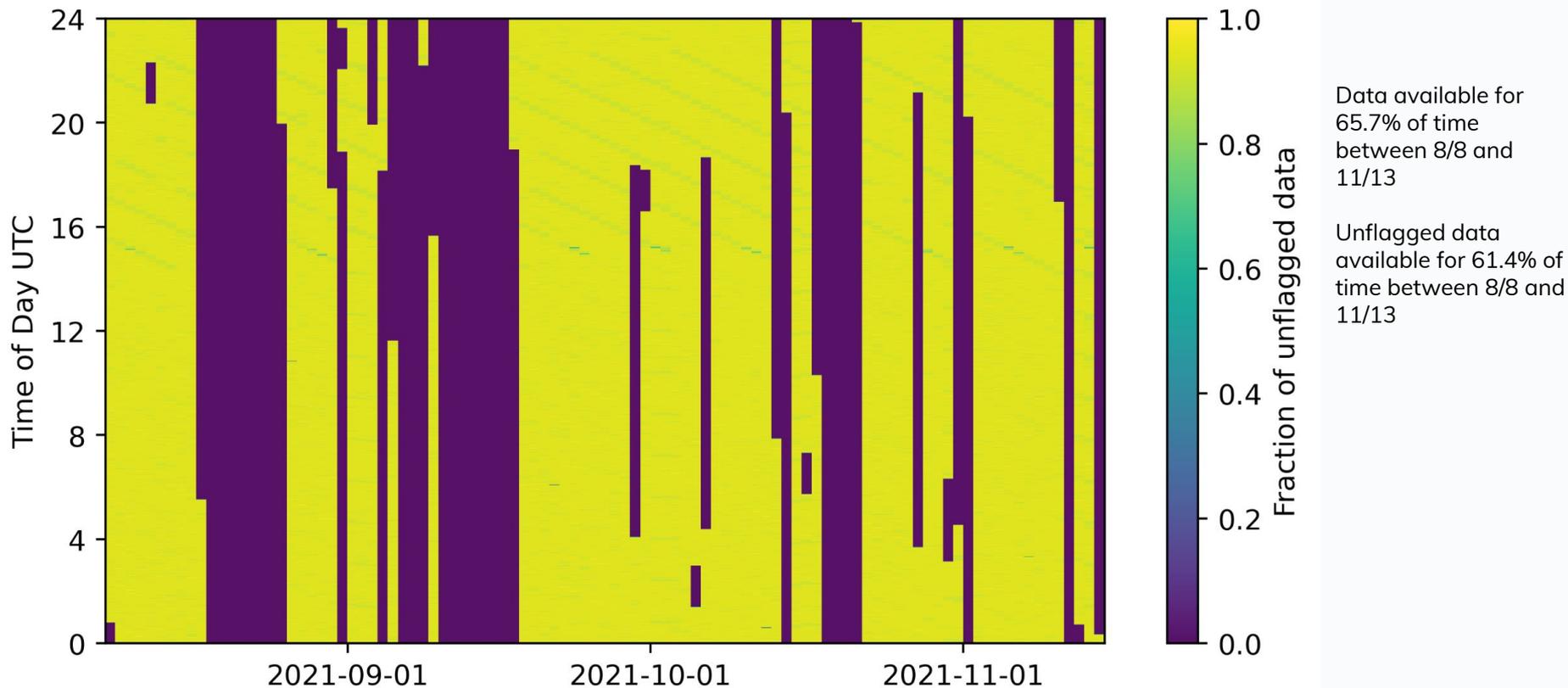
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Ricky Roy, Jeff Steward, Xiaoxu Tian

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Areas of Evaluation

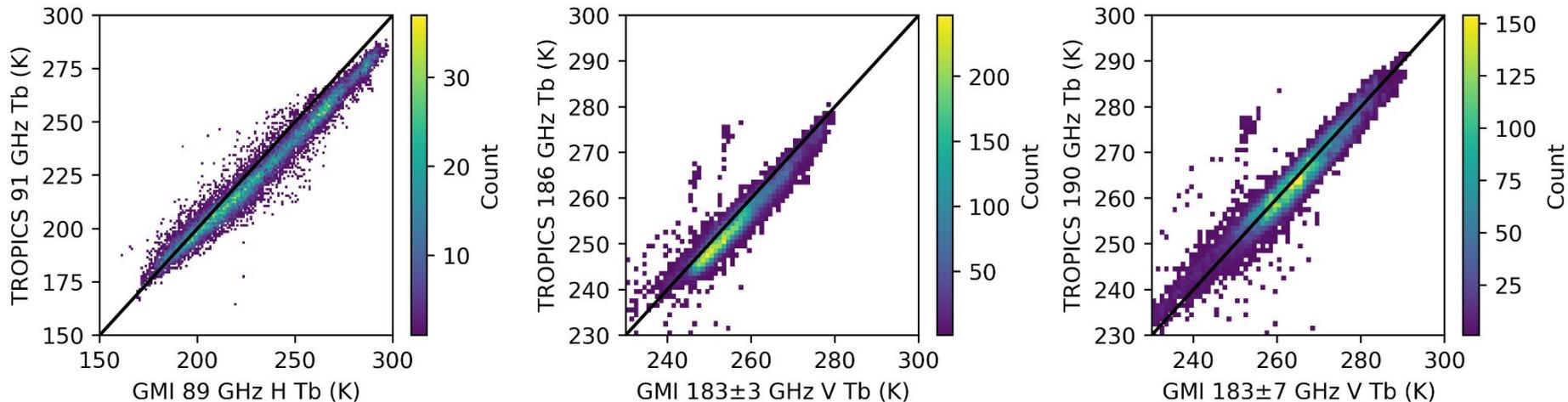
- Overall Reliability
 - What fraction of orbits have useful data?
- Calibration
 - GMI single differences
 - RTTOV/ERA5 Obs-sim
 - Calibration stability over time
- Geolocation
 - Coastline obs vs meas
- Precipitation Detection and Retrieval
 - Initial study from pre-launch databases
 - Comparisons with MRMS

TROPICS Pathfinder Data Availability and Reliability



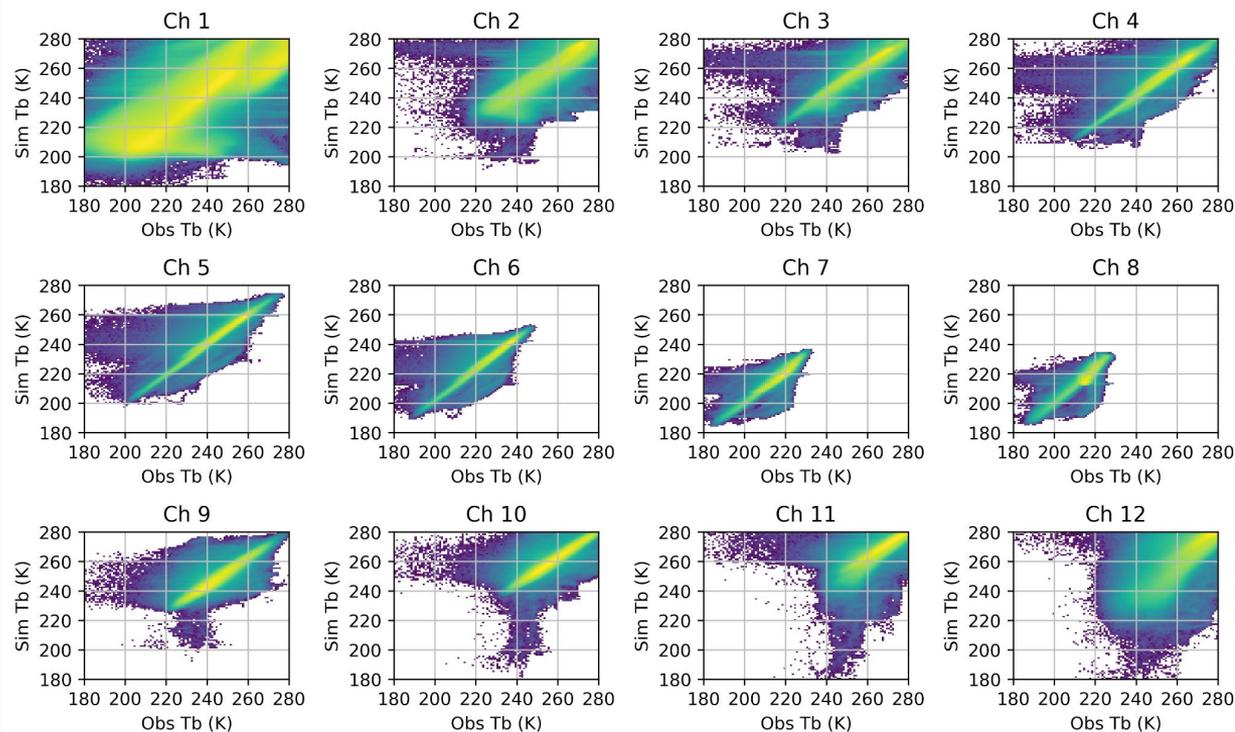
Calibration Assessment

Method: GMI coincident overpasses (< 5 min time difference, <15 km distance, <1° EIA difference),
~18,000 matched observations, GMI spatially averaged to match TROPICS FOV size

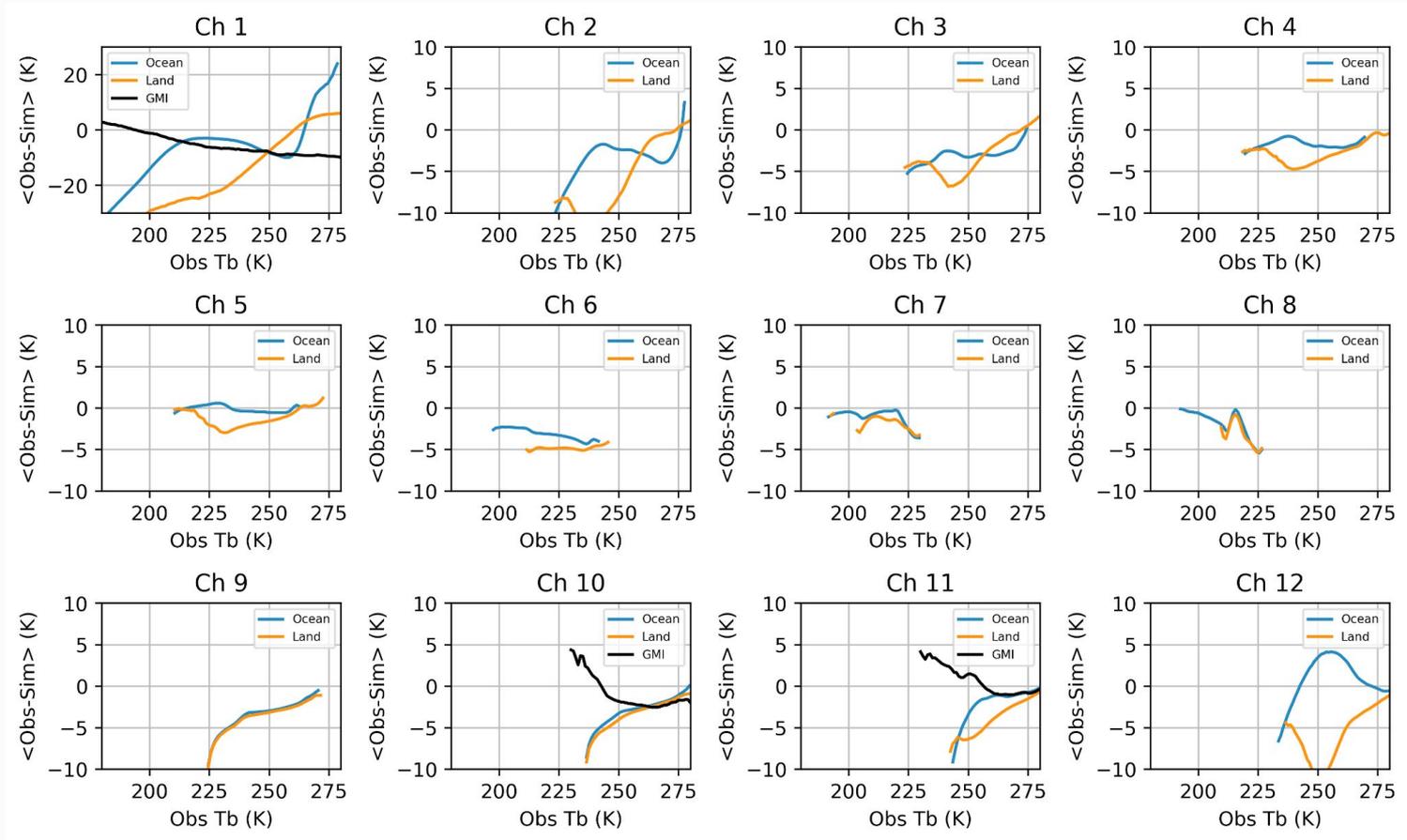


Calibration Assessment

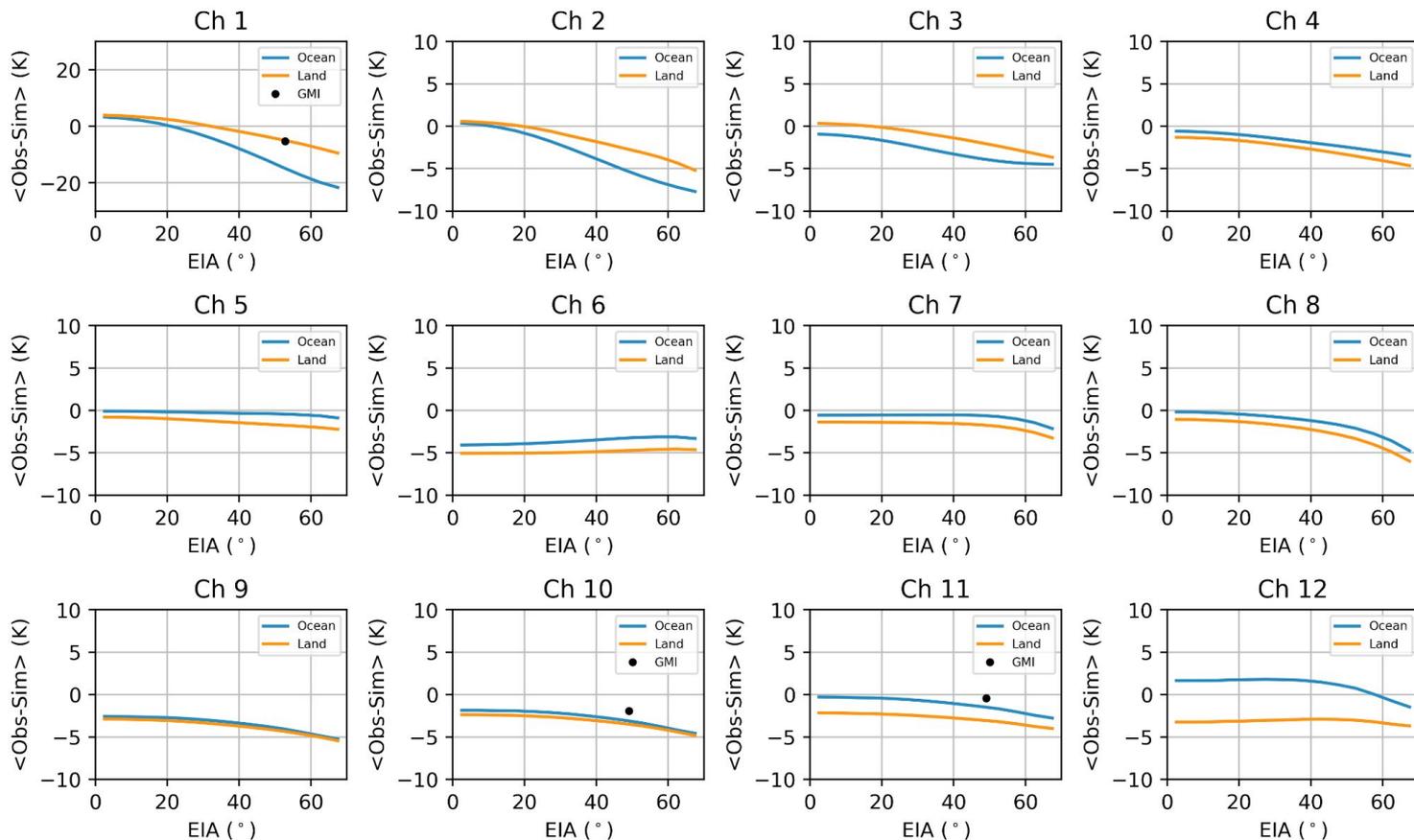
Method: comparing observed brightness temperature to the RTTOV simulated ones, calculated with TROPICS data from Aug. 8 to Sep. 9, 2021 and hourly ERA5 data at 0.25° resolution. Filtered for calibration flags, ERA5 CLW, and observed precipitation scattering. Color scale is $\ln(\text{counts})$.



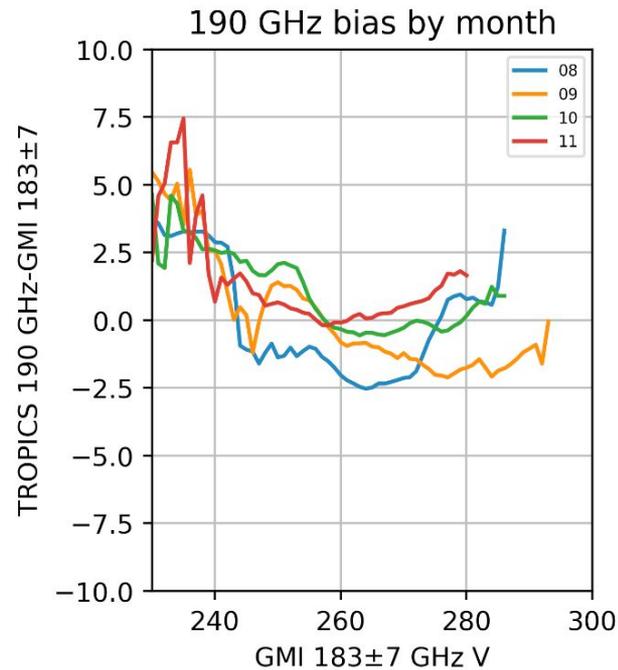
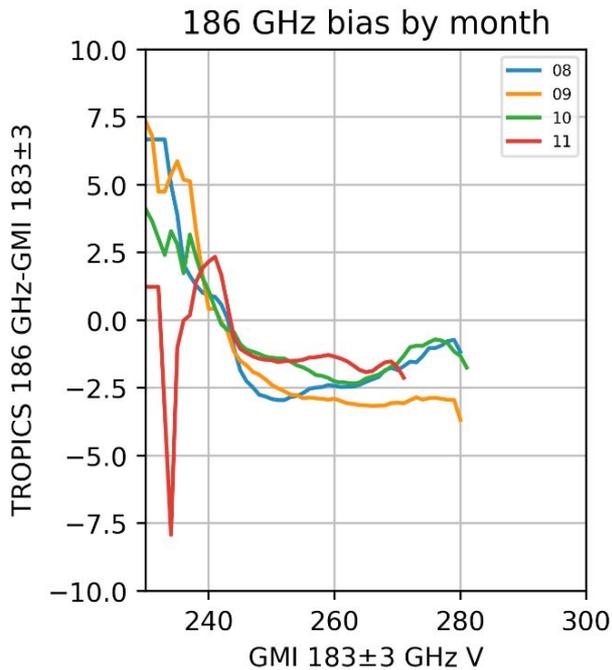
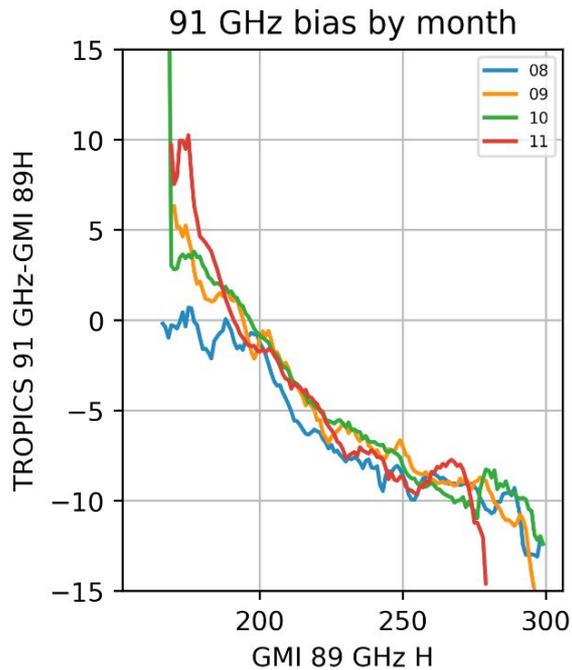
Biases with respect to observed Tbs when compared with RTTOV simulations and GMI



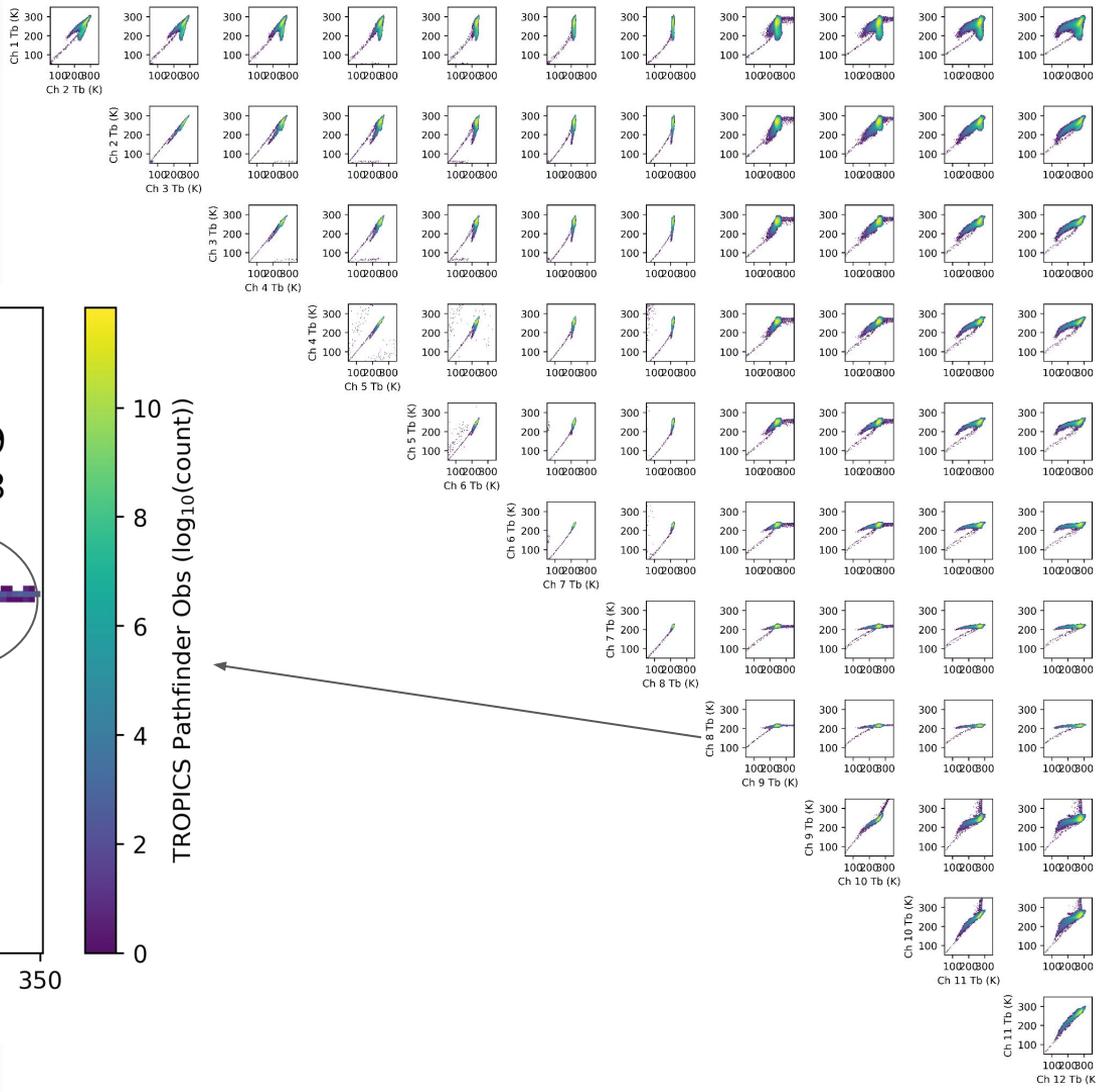
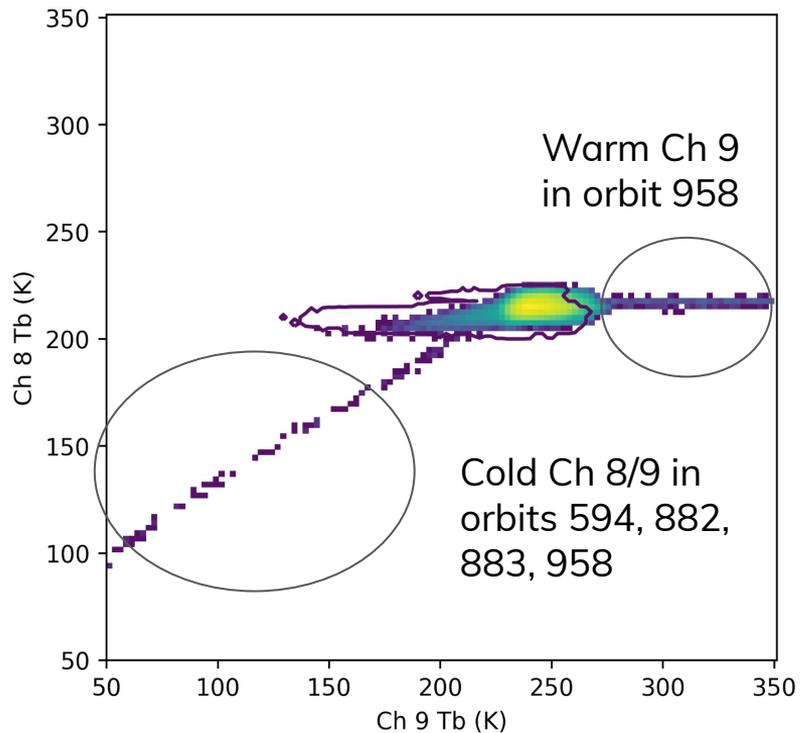
Biases with respect to Earth incidence angle when compared with RTTOV simulations and GMI



Calibration Stability (unflagged observations only)



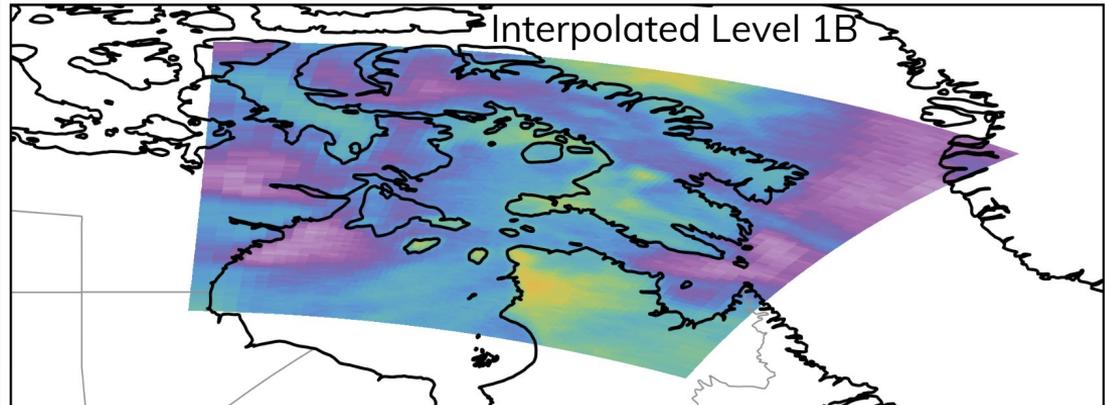
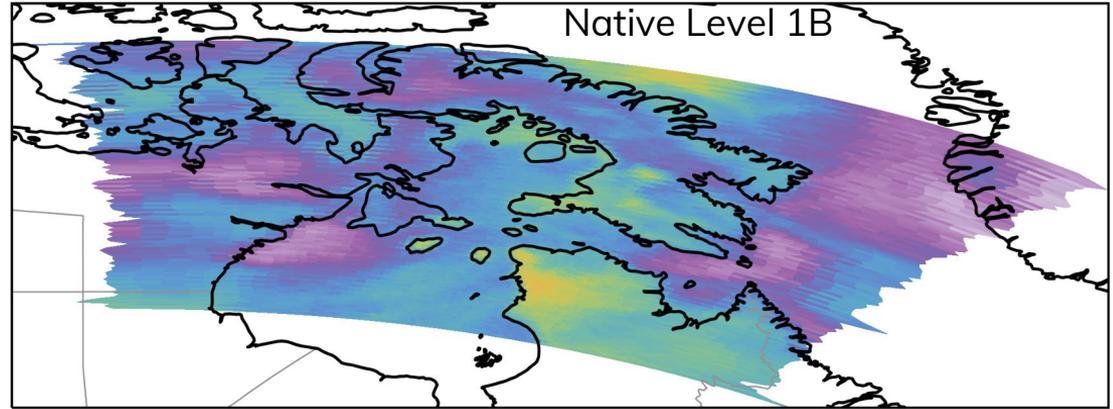
Channel Pair histograms



Geolocation

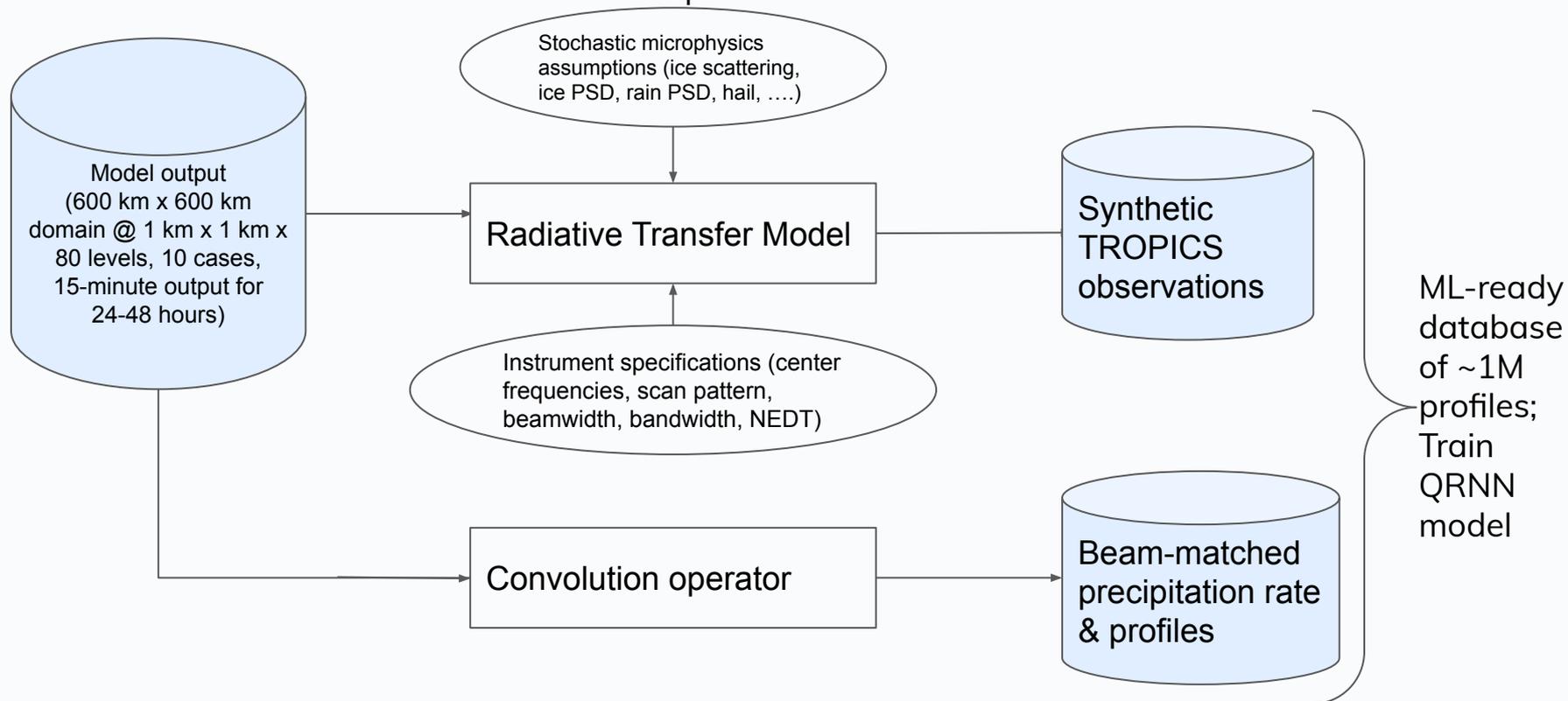
“Knowledge is good, control is not as good”

Verified by interpolating obs to constant scan angles



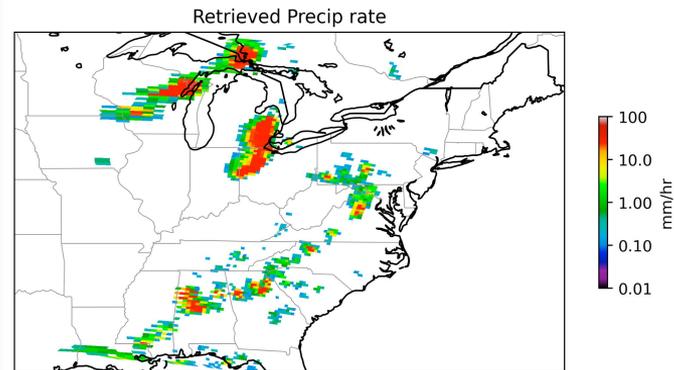
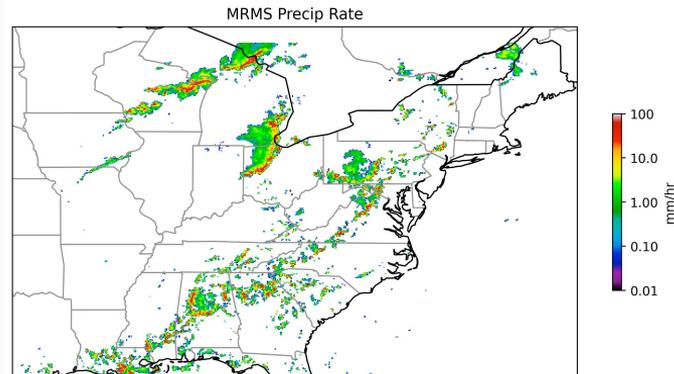
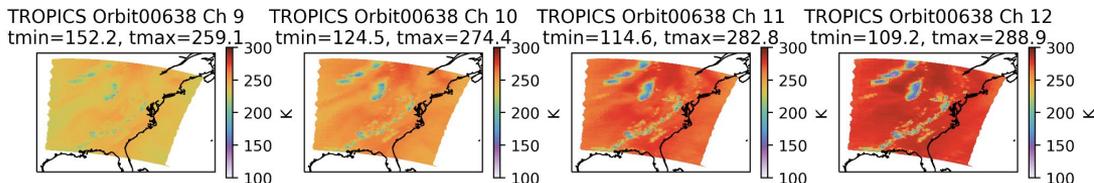
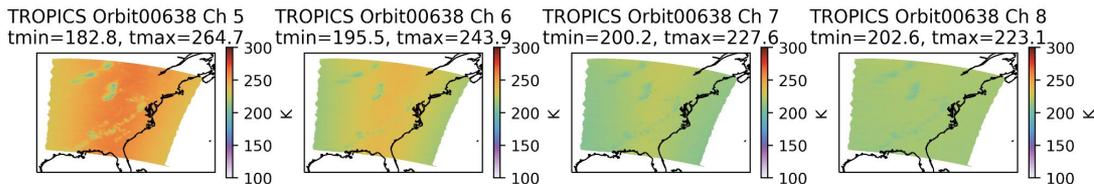
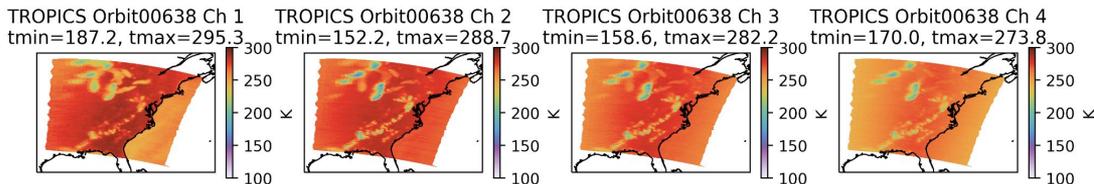
TROPICS Precipitation Retrievals

Tomorrow.io's CBAM model database developed for radar and sounder OSSEs



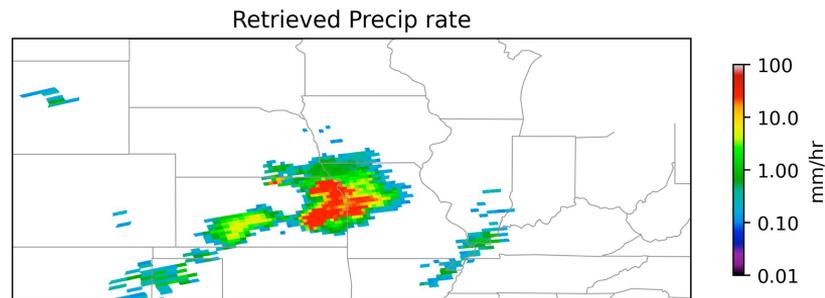
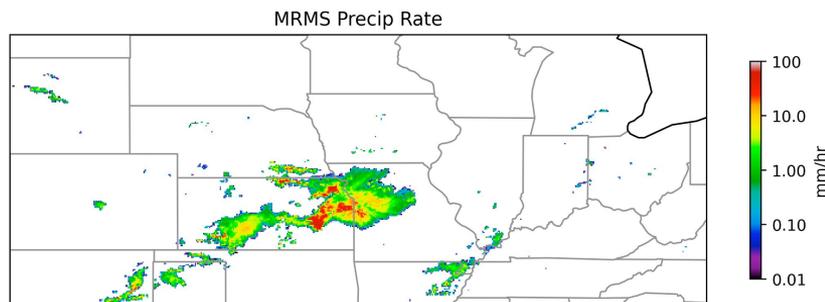
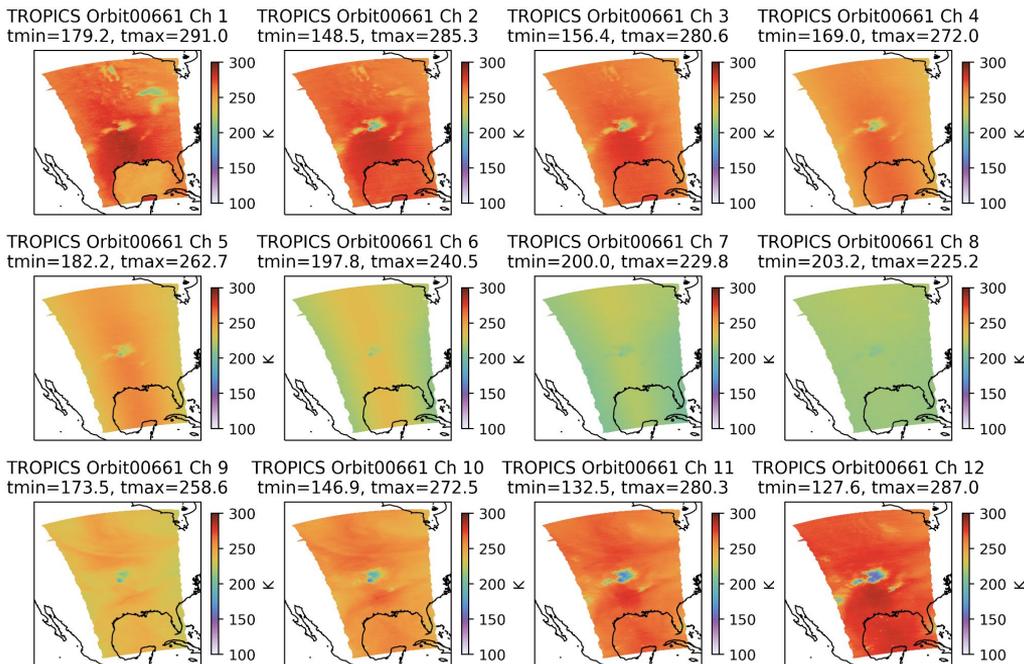
TROPICS Precipitation Retrievals

Squall line and scattered convection on 8/11/2021 at 2015 UTC



TROPICS Precipitation Retrievals

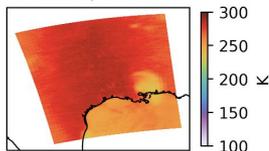
Example of MCS over Kansas/Missouri on 8/13/2021 at 0800 UTC



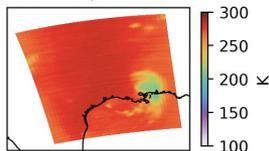
TROPICS Precipitation Retrievals

Hurricane Ida on 8/30/2021 at 0800 UTC

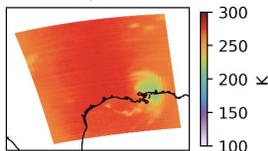
TROPICS Orbit00920 Ch 1
tmin=233.2, tmax=290.2



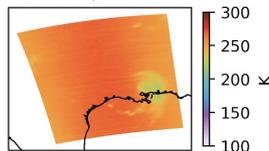
TROPICS Orbit00920 Ch 2
tmin=204.8, tmax=284.4



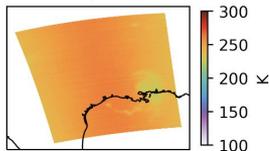
TROPICS Orbit00920 Ch 3
tmin=212.1, tmax=280.0



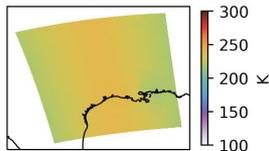
TROPICS Orbit00920 Ch 4
tmin=219.8, tmax=271.3



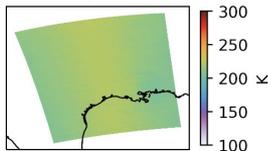
TROPICS Orbit00920 Ch 5
tmin=224.4, tmax=263.0



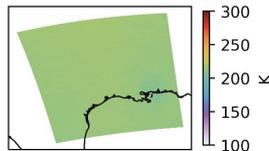
TROPICS Orbit00920 Ch 6
tmin=216.7, tmax=240.9



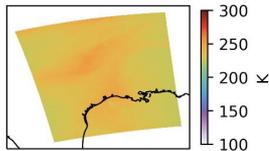
TROPICS Orbit00920 Ch 7
tmin=204.9, tmax=223.5



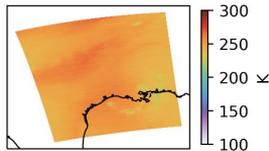
TROPICS Orbit00920 Ch 8
tmin=207.6, tmax=219.7



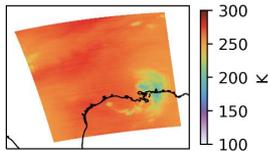
TROPICS Orbit00920 Ch 9
tmin=219.4, tmax=252.8



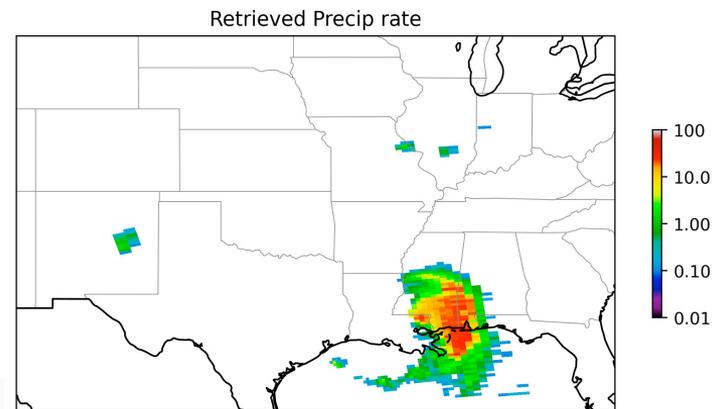
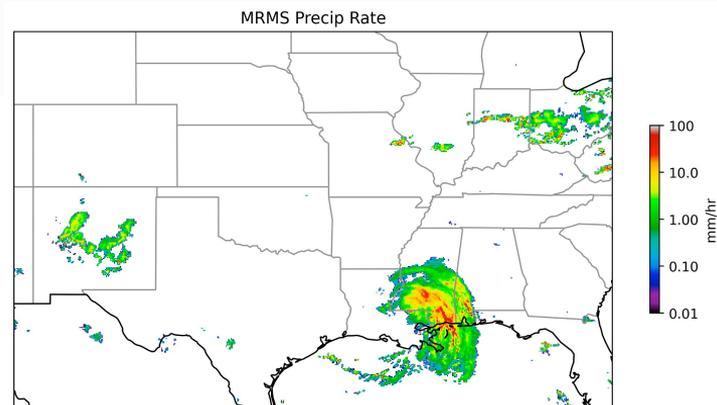
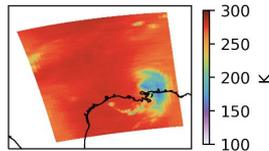
TROPICS Orbit00920 Ch 10
tmin=209.5, tmax=267.0



TROPICS Orbit00920 Ch 11
tmin=191.8, tmax=277.5

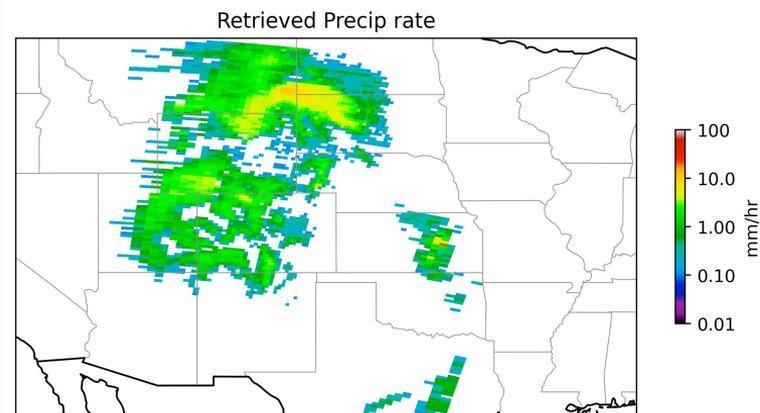
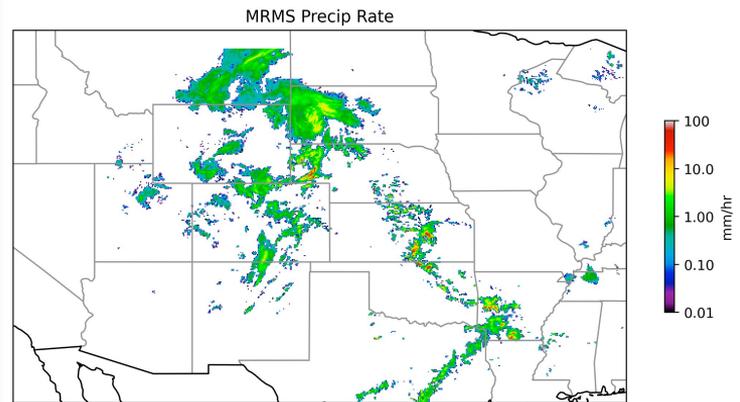
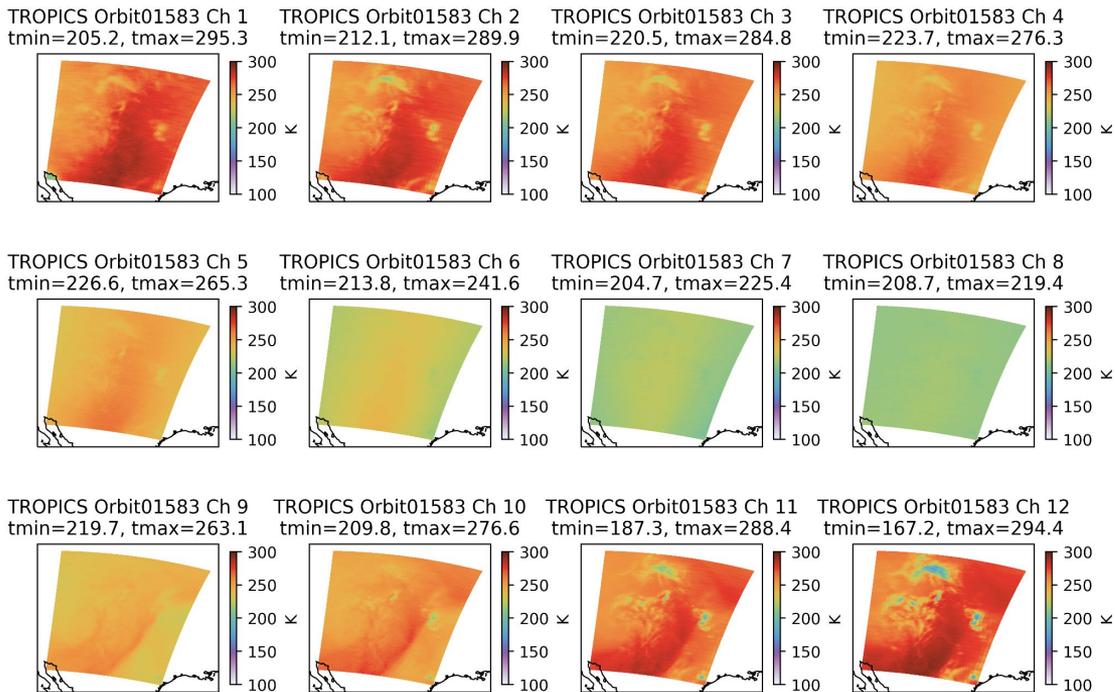


TROPICS Orbit00920 Ch 12
tmin=162.3, tmax=285.5



TROPICS Precipitation Retrievals

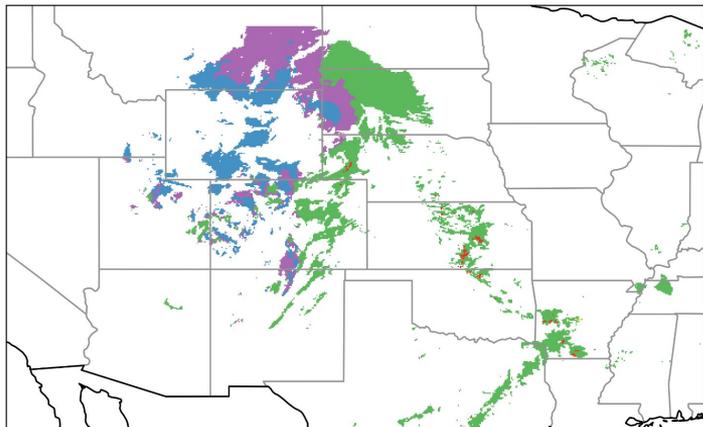
Storm with mountain snow on 10/12/2021 at 2130 UTC



TROPICS Precipitation Retrievals

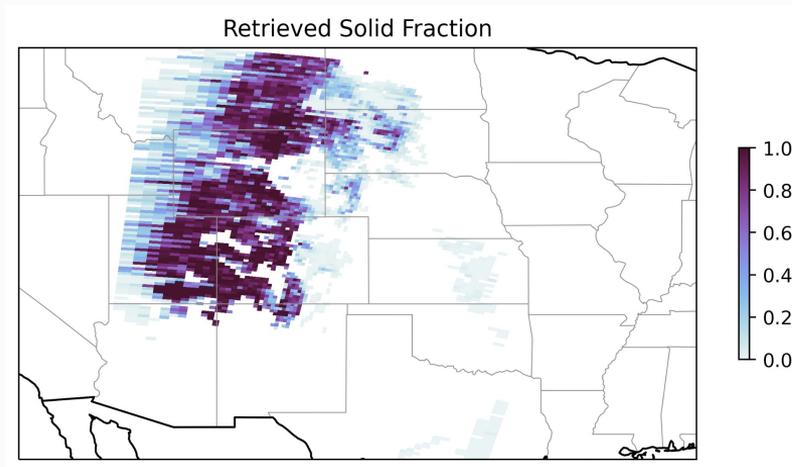
Storm with mountain snow on 10/12/2021 at 2130 UTC

MRMS Precipitation Type



Retrieved Solid Fraction

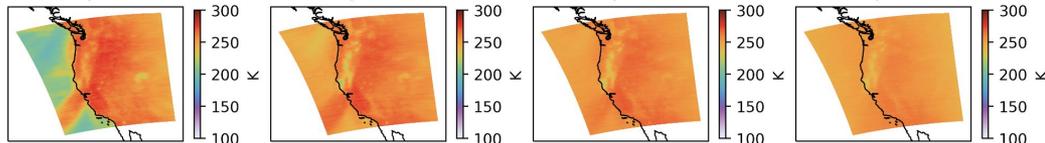
No ancillary data (T2m or TCWV) was used in retrieval!



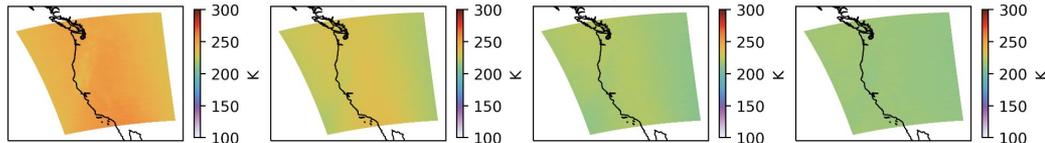
TROPICS Precipitation Retrievals

Atmospheric River on 10/20/2021 at 0930 UTC

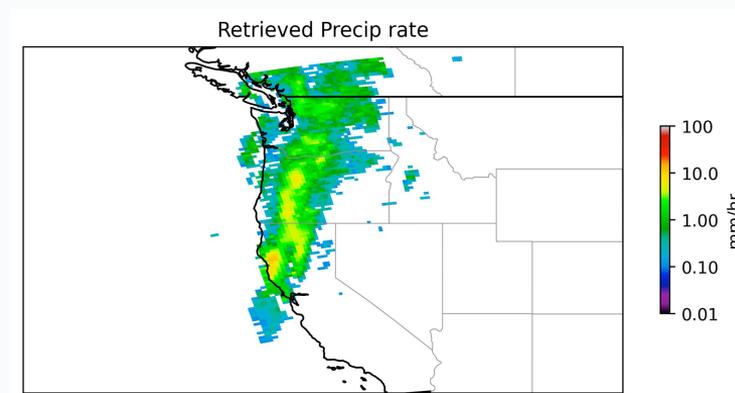
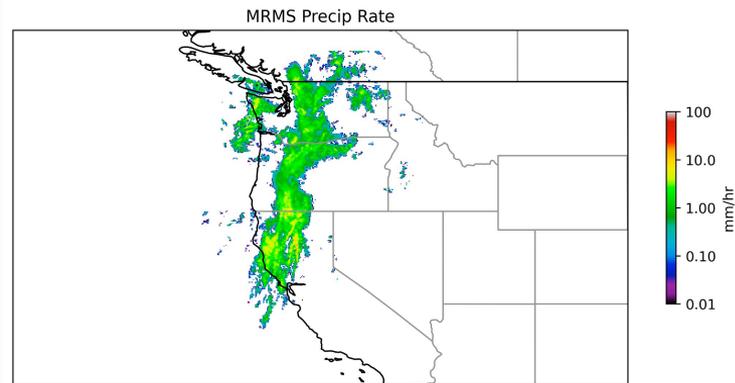
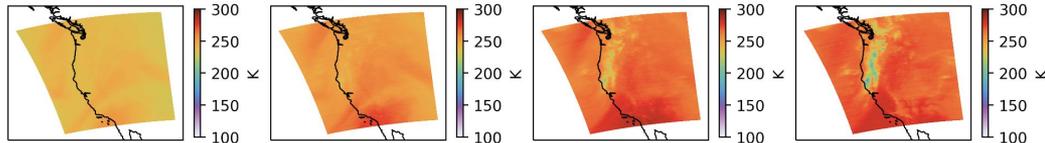
TROPICS Orbit01728 Ch 1 tmin=193.2, tmax=278.3
 TROPICS Orbit01728 Ch 2 tmin=211.3, tmax=275.6
 TROPICS Orbit01728 Ch 3 tmin=219.7, tmax=271.4
 TROPICS Orbit01728 Ch 4 tmin=228.0, tmax=265.4



TROPICS Orbit01728 Ch 5 tmin=232.1, tmax=259.1
 TROPICS Orbit01728 Ch 6 tmin=217.1, tmax=238.1
 TROPICS Orbit01728 Ch 7 tmin=208.6, tmax=224.6
 TROPICS Orbit01728 Ch 8 tmin=210.4, tmax=219.9



TROPICS Orbit01728 Ch 9 tmin=228.9, tmax=255.5
 TROPICS Orbit01728 Ch 10 tmin=232.1, tmax=276.7
 TROPICS Orbit01728 Ch 11 tmin=202.0, tmax=286.8
 TROPICS Orbit01728 Ch 12 tmin=172.0, tmax=283.6



Summary

- TROPICS Pathfinder data release has been examined for calibration/geolocation and precipitation utility.
- Some significant biases are present relative to GMI and RTTOV simulations in some channels
 - Channels 1 and 12 have EIA- and surface-dependent biases - suggesting that polarization mix, channel mix, and/or emissivity model error could be playing a role
 - Most other channels have a slight ($< 5K$) cold bias
 - Channels 5,7, 11 appear to be least biased
- Stability range is $\sim 2K$ at the G-band channels, relative to GMI
- There is clear value of TROPICS channel set for precipitation retrieval
 - Good skill in detecting rain rate > 0.1 mm/hr
 - Some skill in distinguishing rain/snow without ancillary data
 - More work to be done with observational databases